Transport of Escherichia coli phage through saturated porous media considering managed aquifer recharge

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Virus is one of the most potentially harmful microorganisms in groundwater. In this paper, the effects of hydrodynamic and hydrogeochemical conditions on the transportation of the colloidal virus considering managed aquifer recharge were systematically investigated. A novel bacteriophage, vB_EcoM-ep3, has a broad host range and was able to lyse pathogenic E. coli. vB_EcoM-ep3 with low risk to infect human has been found extensively in the groundwater environment, so it is considered as an representative one of groundwater viruses. Laboratory studies were carried out to analyze the transport of the Escherichia coli phage under varying conditions of pH, ionic strength, cation valence, flow rate, porous media and phosphate buffer concentration. The results indicated that decreasing the pH will increase the adsorption of Escherichia coli phage. Increasing the ionic strength, ether Na+ or Ca2+, will form negative condition for the migration of Escherichia coli phage. A comparison of different cation valence tests indicated that changes in transport and deposition were more pronounced with divalent Ca2+ than monovalent Na+. As the flow rate increases, indicating that increase the release of Escherichia coli phage and reduce the retention of Escherichia coli phage in the aquifer medium. Changes in porous media had a significant effect on Escherichia coli phage migration. With increase of phosphate buffer concentration, the suspension stability and migration ability of Escherichia coli phage are both increased. Based on laboratory-scale column experiments, a one-dimensional transport model was established to quantitatively describe the virus transport in saturated porous medium.